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poured on a tile or an iron plate making a cone. A piece of magnesium tape, about 5 centimeters long, has one end thrust into the top of the cone, the other end being bent down so that it is easily lighted by the flame of a match.

Contrary to expectation there is no violent puff or explosion, as with magnesium powder, but a steady progressive combustion, vivid and brilliant, emitting little smoke. When the whole has burned down there remains the most beautiful mass of crystals of aluminium nitride, Al_2N_2 , mixed with some crystals of aluminium oxide.

The greater part of the air which took part in the combustion is thus solidified, only the small amount supporting the combustion of the carbon going off as gases.

When this nitride is heated with a solution of sodium hydrate ammonia gas is evolved.

When the ammonia is mixed with oxygen or air and passed through heated platinum gauze, nitric acid is produced.

When the ammonia and nitric acid are made to react on each other the valuable fertilizer ammonium nitrate results. When this ammonium nitrate is mixed with aluminium powder a very safe but powerful explosive, "Ammonal" is produced.

Thus we learn how intimately these chemical reactions are related in peace to fertilization, and in war to destruction. The experiment illustrates: Combustion in which the nitrogen of the air, as well as the oxygen acts as a supporter of combustion; the production of a crystalline nitride, Al_2N_2 ; synthesis of ammonia; synthesis of nitric acid; fixation of nitrogen to serve as fertilizer; fixation of nitrogen to serve as explosive. It would be unwise for us to conclude that explosives serve only in war. Far from it. Man's best and most serviceable feats in engineering have been made with the aid of these powerful agents. We should not forget how seven acres of rock under Hell Gate were blown to bits by one blast, and our harbor opened up to vessels of greater size.

CHARLES A. DOREMUS

CURRENT RESEARCH AND PUBLICATION IN THE AMERICAN MUSEUM¹

IN cooperation with the United States National Museum and other museums, North America from the Arctic to the Isthmus is now well covered by American Museum activities. Its work includes explorations, publications and photographic collections, relating to historic and prehistoric races of men, to the insects, fishes, amphibians, reptiles, birds and mammals, as well as to the extinct ancestors of these living groups. Especially noteworthy serial publications on recent explorations, completed or well advanced, are papers on the "Anthropology of the Southwest" with the Archer M. Huntington Fund, the "Bibliography of Fishes" with the Jesup Fund, continued by Professors Dean and Gudger, and six volumes on "Fossil Vertebrates" with the Jesup Fund. Aided by the Jesup Fund, Professor Osborn, as a member of the staff of the United States Geological Survey, has just completed his monograph, "Titanotheres of Western America," on which he has been engaged for nineteen and a half years.

About \$75,000 has been expended since 1910 on South American exploration and publication through successive expeditions led by Chapman, Roosevelt, Cherrie, Miller and Richardson. The senior curator, Dr. J. A. Allen, has produced a series of standard papers on South American mammals. Expeditions into the interior bear the name of Theodore Roosevelt. Dr. Chapman's "Distribution of Bird-Life in Columbia," recently awarded the Daniel Giraud Elliot Medal by the National Academy of Sciences, is a classic and leads to similar volumes on the birds of Ecuador, of Peru and of Chile.

The Museum has thus far expended \$190,000 on African exploration, research and publication. Unrivalled collections of reptiles, birds and mammals are in storage awaiting the construction of the African Hall, as the result of the untiring field work of a suc-

¹ Modified from the fifty-first annual report of the president, Henry Fairfield Osborn, May, 1920.

cession of explorers, namely, Roosevelt, Tjäder, Akeley, Rainsford, Barnes, Rainey, Lang and Chapin. The two last named have rendered monumental service to African natural history in bringing out the most complete and the most perfectly preserved collection which has ever come from Africa, with precise field notes and 9,500 photographs. The results are being issued in a series of twelve volumes entitled "The Zoology of the Belgian Congo." To these volumes many other specialists of the country are contributing, notably Director W. J. Holland, of the Carnegie Museum, Professor William Morton Wheeler, of Harvard University, and Dr. Henry A. Pilsbry, of the Academy of Natural Sciences of Philadelphia. The first two Congo volumes were recently presented to the King of the Belgians following his visit to the Museum. A duplicate collection of Congo types is being sent to the great Congo Museum at Tervuren, Belgium, according to the agreement of the Museum with the Belgian government.

Through the successive journeys of Mr. Roy C. Andrews in Japan, Korea, the Provinces of Yunnan, Fukien, Shansi, and in Mongolia, aided by the Rev. Harry R. Caldwell, the Museum has made a notable beginning in the collections representing the eastern mountain, plain and desert life in Asia. Examples of the life of tropical Asia and Indo-Malaya are still required. All together there has been expended \$35,000 in Asiatic exploration and publication up to the present time.

Popular scientific works are carrying the work of the Museum to readers all over the world. The series of popular volumes by Peary, Stefánsson, MacMillan, Roosevelt, Chapman, Miller, Wissler, Andrews and Lutz constitutes a library of standard reference on Arctic exploration, on African, Asiatic and South American travel, and on the ancient and recent history of the primitive races of Europe and of North America. Among these volumes are the following:

Peary, Robert E.

Northward Over the Great Ice, 1898.

The North Pole, 1910.

Secrets of Polar Travel, 1917.

Stefánsson, Vilhjalmur

My Life with the Eskimo, 1913.

MacMillan, Donald B.

Four Years in the White North, 1918.

Roosevelt, Theodore

Through the Brazilian Wilderness, 1914.

Chapman, Frank M.

Bird Studies with a Camera, 1898.

Camps and Cruises of an Ornithologist, 1908.

Handbook of Birds of Eastern North America, 1912.

The Travels of Birds, 1916.

Our Winter Birds, 1918.

Miller, Leo F.

In the Wilds of South America, 1918.

Wissler, Clark

North American Indians of the Plains, 1912.

The American Indian, 1917.

Andrews, Roy C.

Whale Hunting with Gun and Camera, 1916.

Camps and Trails in China, 1918.

Lutz, Frank E.

Field Book of Insects, 1918.

Osborn, Henry Fairfield

The Age of Mammals, 1910.

The Origin and Evolution of Life, 1917.

For publication as well as for the enrichment of the collections and the preparation of exhibitions, the total sum of \$1,412,839.32 has been expended, since Mr. Jesup's decease in 1908, from the income from the Morris K. Jesup Fund, which by the terms of the will is devoted to purely scientific purposes. The research product of the Museum has grown accordingly; the volume of publications has increased several fold; the popular publications, based on the pure researches of their authors, have spread the educational influence of the Museum all over the world. It is interesting to observe that certain branches of science relinquished by many of our universities are taken up by our museums.

The sales of popular publications have reflected the character of the public attendance and interest, being greater than ever, particularly of the *Guide*, which was exhausted much sooner than expected and "out of print" for four months. All together there were sold at the attendants' desks 3,005

Guides, 1,886 *Handbooks*, 3,087 *Leaflets* and 1,044 *Reprints*, a total of 9,022 copies.

The publications of The American Museum of Natural History for the current year include the *Annual Report*; the *Bulletin*; the *Anthropological Papers*; *Natural History*, the Journal of The American Museum of Natural History; the *Guide Leaflets*, and the *Handbooks*. During 1919 Volume XLI. of the *Bulletin* was published, which contained three articles on mammalogy, one on ichthyology, nine on invertebrate zoology, three on vertebrate palæontology, two on herpetology, one on ornithology and one on invertebrate palæontology. Also two volumes relating to the Belgian Congo were published: Volume XXXIX., containing a monograph by Bequaert on "A Revision of the Vespidae of the Belgian Congo" and a monograph by Schmidt on "Contributions to the Herpetology of the Belgian Congo"; and Volume XL., which is devoted entirely to Pilsbry's paper on "A Review of the Land Mollusks of the Belgian Congo." The collection of papers on the Belgian Congo has steadily increased; a "List of Reports on the Results of The American Museum Congo Expedition" published this year contains a short description of fifteen such papers.

For the most part the members of the anthropological staff gave their time to the data obtained on former field expeditions. Problems of racial distinction and origins were developed by Assistant Curator Sullivan and Dr. Bruno Oettking. Mr. Sullivan, with the cooperation of the department of physiology, made a series of microphotographs of racial hair cuttings for study and exhibition. His main investigation, however, concerned itself with a series of measurements upon full and mixed-blood Indians made some years ago under the direction of Professor Franz Boas. These data have been thoroughly compiled and correlated to show the results of race mixture. Among some of the significant conclusions are the constancy of degrees of correlation between bodily proportions even in mixed-bloods and the apparent inheritance of specific correlations between face width and breadth

of head. Dr. Oettking completed the measurement and description of the skulls for northeastern America and eastern Siberia, for a report upon the physical anthropology of the Jesup North Pacific Expedition.

Facilities for promoting research in human biology have been greatly improved during the year. A room adjoining the physiological laboratory has been equipped as an anthropometric laboratory and office for Assistant Curator Sullivan. By special arrangement the equipment of the physiological laboratory is now available for the work of this department. The Galton Society has organized a special laboratory for the study of racial characters, which, for the present, is housed in this department, the curator being the chairman of its governing committee and Assistant Curator Sullivan its director.

Assistant Curator Spinden discovered a correlation between the calendars of the Aztec and Maya that promises to give an unbroken historical record for the New World from the beginning of the Christian era. Mr. Leslie Spier has completed an exhaustive study of the sun dance of the Plains Indians, revealing some interesting culture movements among these tribes. Dr. Elsie Clews Parsons has nearly completed a detailed analysis of the social organization of the Rio Grande Pueblo Indians.

The *Anthropological Papers* deal entirely with the work of the department of anthropology. These papers are now in their twenty-ninth volume. The nine parts which appeared during 1919 include articles on various phases of the history of the Crow, Aztec, White Mountain Apache, Eskimo and Philippine tribes, and make a total of 713 pages, 125 text-figures and 3 maps. Among these articles are "Kinship in the Philippines," by A. L. Kroeber, Vol. XIX., Part III.; "Myths and Tales from the White Mountain Apache," by P. E. Goddard, Vol. XXIV., Part II.; and "The Aztec Ruin," by Earl H. Morris, Vol. XXVI., Part I. An important *Guide Leaflet* on "Indian Beadwork" was prepared by Dr. Wissler. The *Handbook* on the "Peoples of the Philippines," by A. L. Kroeber, has just

appeared. It gives an interesting account of the ethnology and culture of the peoples of these islands.

HENRY FAIRFIELD OSBORN

NOTES ON METEOROLOGY AND CLIMATOLOGY

THE EFFECT OF SNOW UPON THE GROWTH OF WINTER WHEAT

It has long been believed that a snow cover is a beneficial factor in the growth of winter wheat; but some doubt has recently been cast upon this view, at least with respect to Ohio and Illinois, for which the question has been studied. Two short papers, one by Mr. Clarence J. Root¹ and the other by Professor J. Warren Smith,² have served as introductory to a longer discussion by Mr. T. A. Blair.³ Professor Smith draws a clear distinction between the quantity of snowfall with its subsequent effect and the effect of a snow covering, for it may well be that a very heavy snow will melt quickly and leave the ground bare for a considerable time, or that a very light snow will remain for a long time unmelted on the ground. Thus, the question of the relation of snow and winter wheat is divided into two distinct aspects.

The first aspect has been discussed by Mr. Blair. His method of treating the problem is two-fold: first, by the well-known method of partial correlation, and second, by expressing the yield in linear regression equations of the form $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \dots$, in which Y is the yield; x_1, x_2, x_3, \dots are the various weather elements, such as mean temperature, total precipitation, sunshine, etc.; and b_1, b_2, b_3, \dots are constants for a given equation depending upon the data. In expressing such relationships, the author has had to assume that there is a linear relation

¹ "The Relation of Snowfall to the Yield of Winter Wheat," *Mo. Weather Rev.*, October, 1919, Vol. 47: 700, 4 figs.

² "The Effect of Snow on Winter Wheat in Ohio," *ibid.*, pp. 701-702, fig.

³ "A Statistical Study of Weather Factors Affecting the Yield of Winter Wheat in Ohio," *ibid.*, December, 1919, Vol. 47: 841-847, 2 figs.

between the weather and yield, which, as he says, "is doubtful in cases of extreme weather conditions," and also that the most important weather influences have been included in his equations. Of the latter, perhaps the most important are temperature and precipitation, although there are many other factors which are not considered owing to lack of data, but which are more or less directly related to the weather, namely, hessian fly and other insects, severe storms, hail, and loss of crop by storm after it is cut.

Taking the state of Ohio as a whole, Mr. Blair finds that there is little evidence that there are monthly values of weather elements which exert a profound influence upon the yield of wheat. After obtaining this negative result, he proceeds to treat smaller areas of the state and shorter periods than the month. First, confining his area to Fulton county, and his period to 10 days, he finds that there are certain conditions of temperature and precipitation—the former more than the latter—operative over short periods, and these are the dominant factors in determining the final yield.

His conclusions, which seem to cast doubt upon the validity of the practise of the Bureau of Crop Estimates in publishing crop estimates as early as December 1, show that for the state as a whole, a warm March and June and a cool, dry May are favorable for a high yield. There are certain critical stages in the development of the plant, in which the conditions during certain 10-day periods may exert an important influence, especially in northern Ohio. It is found that the weather should be cool during the jointing stage, dry during the development of the boot, warm while the head is filling, and warm during the last ten days of stooling. As to the quantity of snowfall, it appears that a heavy fall of snow in March is detrimental. Forecasts of yield, earlier than May or June, believes Mr. Blair, can be of little value, because of the great influence of temperature during those months.

The second aspect of the distinction drawn by Professor Smith, was investigated by Mr.